

19



Europäisches Patentamt  
European Patent Office  
Office européen des brevets

11 Publication number:

**0 289 610**  
**A1**

12

# EUROPEAN PATENT APPLICATION

published in accordance with Art. 158(3) EPC

21 Application number: 87906763.5

51 Int. Cl.: H 02 K 5/173

22 Date of filing: 14.10.87

Data of the international appli-  
cation taken as a basis:

25 International application number:  
PCT/JP 87/0077227 International publication number:  
WO 88/02945 (21.04.88 88/9)

30 Priority: 15.10.86 JP 243205/86

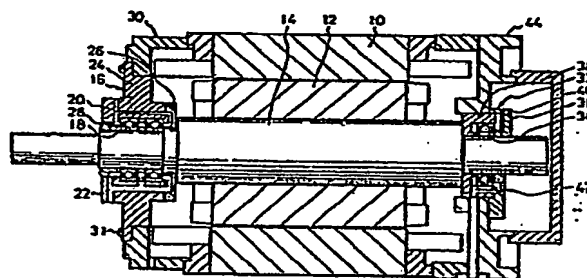
43 Date of publication of application: 09.11.88  
Bulletin 88/45

24 Designated Contracting States: DE FR GB

71 Applicant: FANUC LTD, 3580, Shibokusa Aza-Komanba  
Oshino-mura, Minamitsuru-gun Yamanashi 401-05 (JP)72 Inventor: KATSUZAWA, Yukio, 724, Shimoyugi,  
Hachioji-shi Tokyo 192-03 (JP)  
Inventor: MASUYA, Michi, FANUC Hino Ryo 3-27,  
Tamatsira, Hino-shi Tokyo 191 (JP)74 Representative: Allman, Peter John, MARKS & CLERK  
Suite 301 Sunlight House Quay Street, Manchester  
M3 3JY (GB)

## 54 BEARING STRUCTURE OF HIGH SPEED MOTOR.

57 When the output shaft (14) of a high speed motor is supported pivotally by accommodating front and rear bearings (18) and (34) on the center side of housings (30, 34) at the front and rear end portions of a motor housing, respectively, the present invention provides a bearing structure of a high speed motor using oil-air lubrication by constituting the inner peripheral portion (16, 32) of each of the front and rear housings in such a manner as to be capable of being separated from or assembled to respective outer peripheral portion and to facilitate machining, and a supply path (20, 40) of oil-air and a drain path (22, 42) are disposed on each inner peripheral portion.



EP 0 289 610 A1

ACTORUM AG

BEST AVAILABLE COPY

TITLE MODIFIED  
see front page

FF-6374-PCT

- 1 -

00289610

DESCRIPTION

TITLE OF THE INVENTION

Structure of Journal Bearing for Motor Operating at  
High Revolutionary Speeds

TECHNICAL FIELD

The present invention relates to a structure of a  
5 journal bearing for a motor, particularly to a structure  
of a journal bearing by which a channel for supplying an  
oil-air mix lubrication medium and a drain channel can  
be easily arranged within a motor operating at high  
revolutionary speeds.

10 BACKGROUND ART

Recently, the spindle of a machine tool must be  
able to rotate at a very high speed, and thus  
conventionally, a motor for rotating at a medium speed  
is used and an increased revolutionary speed is obtained  
15 by using a transmission mechanism and thus the spindle  
is driven at a high revolutionary speed.

Nevertheless, problems arise such as a time lag in  
the revolution of the spindle when the revolution speed  
of the spindle is changed, and so on, whereby the  
20 finishing accuracy of a workpiece is reduced.

Therefore, a spindle motor directly connected to the  
spindle of a machine tool is required, and thus a  
journal structure capable of enduring a high  
revolutionary speed becomes necessary. A journal  
25 bearing under a conventional grease lubrication becomes  
overheated at a high revolutionary speed such as  
represented by the value  $Dmn$ , which is obtained by  
multiplying an average diameter of an inner diameter and  
an outer diameter of the journal bearing by the  
30 rotational speed, and is substantially equal to or more  
than one million (for example, where the average  
diameter is 50 mm and the rotational speed is twenty  
thousand r.p.m.), and normal driving cannot be  
maintained. Therefore, an oil-air mix lubrication which

supplies air containing an oil mist is needed.

Although the oil-air mix lubrication is needed for a normal driving of a motor at high revolutionary speeds, as described hereinafter, it is difficult to provide a channel for supplying an oil-air mix and a drain channel for a complex oil-air mix lubrication in a conventional journal bearing structure mounted in a onepiece type motor housing.

#### DISCLOSURE OF THE INVENTION

Accordingly, an object of the present invention is to provide a journal bearing structure for a motor operating at a high revolutionary speed, wherein a channel for supplying an oil-air mix and a drain channel are easily arranged, thus solving the above problems.

In view of the foregoing object, the present invention provides a journal bearing structure for a motor operating at a high revolutionary speed, characterized in that each inner portion of a front housing and a rear housing of a motor is constructed in such a way that it can be separated from the remaining outer portion and can be assembled, a channel for supplying an oil-air mix and a drain channel are provided on each inner portion of the front housing and the rear housing, a journal bearing is mounted in each central side of the inner portion of the front housing and the inner portion of the rear housing, and each inner portion in which the journal bearing is mounted is inserted and set onto an output shaft of the motor, to thus act as a journal bearing structure using an oil-air mix in which the output shaft rotates and to serve as portions of the front housing and the rear housing, respectively. According to the above mentioned journal bearing structure, the housing portions for sustaining the front and rear journal bearings of the motor can be separated from the remaining housing portion of the motor and be machined, and therefore, a complex channel for supplying an oil-air mix, and a drain channel, which

are needed for the journal bearing of the motor operating at a high revolutionary speed, can be easily provided.

#### BRIEF DESCRIPTION OF THE DRAWINGS

5        Figure 1 is a longitudinal sectional view of a motor operating at a high revolutionary speed and having the journal bearing structure according to the present invention.

#### BEST MODE FOR CARRYING OUT THE INVENTION

10        The present invention will be described in more detail hereinafter according to the embodiment shown in the attached drawing. An output shaft 14 having a rotor 12 fixed thereto is supported rotatively at the front and rear portions thereof by a front journal  
15 bearing 18 and a rear journal bearing 34 disposed in a motor housing, respectively. The motor housing is usually constructed by a central stator portion 10, a front housing 30 holding the front journal bearing 18, and a rear housing 44 holding the rear journal  
20 bearing 34. Furthermore, these journal bearings are lubricated by a grease.

A bearing lubricated by grease will overheat, as the condition of the grease deteriorates when the bearing is used at a high revolutionary speed such as  
25 represented by the value Dmn, which is equal to or higher than one million. This value is obtained by multiplying an average diameter of the inner and outer diameters of the journal bearing by the rotational speed and shows the degree of severity of the conditions for  
30 the operation of the journal bearing. Accordingly, an oil-air mix lubrication which supplies a small amount of oil mixed with air is required. A channel for supplying the oil-air mix and a drain channel must be provided near the journal bearing to realize this oil-air mix  
35 lubrication. As the channel for supplying the oil-air mix and the drain channel have a complex configuration and a flange portion is provided on the front and rear

housings, it is difficult to directly machine the large front or rear housings 30 or 44.

Therefore, an inner portion 16 of the front housing 30 and an inner portion 32 of the rear housing 44 are constructed that they can be separated from and assembled to the front housing 30 and the rear housing 44 respectively, and thus the aforesaid machining can be easily carried out.

The inner portion 16 of the front housing 30 is divided into a main body portion 24 for holding the front journal bearing 18 and an end plate 26 abutting against the lateral end surface of the main body portion 24, whereby the machining and forming of the channel 20 for supplying an oil-air mix, and of the drain channel 22, is made easy. The front journal bearing 18 held by the main body portion 24 and the end plate 26 is fixed in the axial direction by inserting a bearing support ring 28 after the bearing 18 is inserted onto the shaft 14. Also, the main body portion 24 is fixedly attached to the remaining outer portion of the front housing 30 by, for example, screw bolts 31. The main body portion 24 and the end plate 26 are also connected to each other by, for example, screw bolts.

The inner portion 32 of the rear housing 44 is divided into a main body portion 38 for holding the rear journal bearing 34 and a support ring plate 36 for supporting the bearing in the axial direction, and thus the machining and forming of a channel 40 for supplying an oil-air mix, and of a drain channel 42, is made easy.

The output shaft 14 to be journaled by the above-mentioned journal bearings 18 and 34 may be integral with the spindle of a machine tool. That is, the motor may be a type having a built-in spindle. Furthermore, if necessary, a journal bearing using a grease lubrication can be used in the present structure at the front or the rear housings.

As apparent from the foregoing description,

according to the present invention, the machining and forming of the channel for supplying an oil-air mix, and of the drain channel, can be easily carried out because the front and rear housings of the motor for operating  
5 at a high revolutionary speed are constructed in such a way that they can be separated from the remaining motor housing portion, and therefore, lubrication by an oil-air mix is possible; namely, an accurately machined journal bearing structure for a high revolutionary speed  
10 motor can be provided.

LIST OF REFERENCE NUMERALS

- 10 ... Stator portion
- 12 ... Rotor
- 14 ... Output shaft
- 16 ... Inner portion of front housing
- 18 ... Front journal bearing
- 20 ... Channel for supplying oil-air mix lubrication
- 22 ... Drain channel
- 24 ... Main body portion for front journal bearing
- 26 ... End plate
- 28 ... Bearing support ring
- 30 ... Front housing
- 32 ... Inner portion of rear housing
- 34 ... Rear journal bearing
- 36 ... Support ring plate
- 38 ... Main body portion for rear journal bearing
- 40 ... Channel for supplying oil-air mix lubrication
- 42 ... Drain channel
- 44 ... Rear housing

CLAIMS

1. A structure of a journal bearing for a motor  
for operating at a high revolutionary speed, wherein a  
front journal bearing and a rear journal bearing are  
accommodated, respectively, in a central portion of a  
5 front housing and a rear housing of a motor housing so  
that an output shaft is journaled, characterized in that  
each inner portion of said front housing and of said  
rear housing is constructed in such a way that said each  
inner portion can be separated from and be assembled to  
10 each outer portion of said each housing, to thereby  
enable a machining thereof to be easily realized, a  
channel for supplying an oil-air mix, and a drain  
channel, being provided in said each inner portion, the  
journal bearing being mounted in each central portion of  
15 said each inner portion, each inner portion having said  
journal bearing mounted therein being inserted to and  
set on said output shaft to comprise a journal bearing  
structure using an oil-air mix lubrication, for  
journaling said output shaft and to form said portion of  
20 said front housing and of said rear housing,  
respectively.

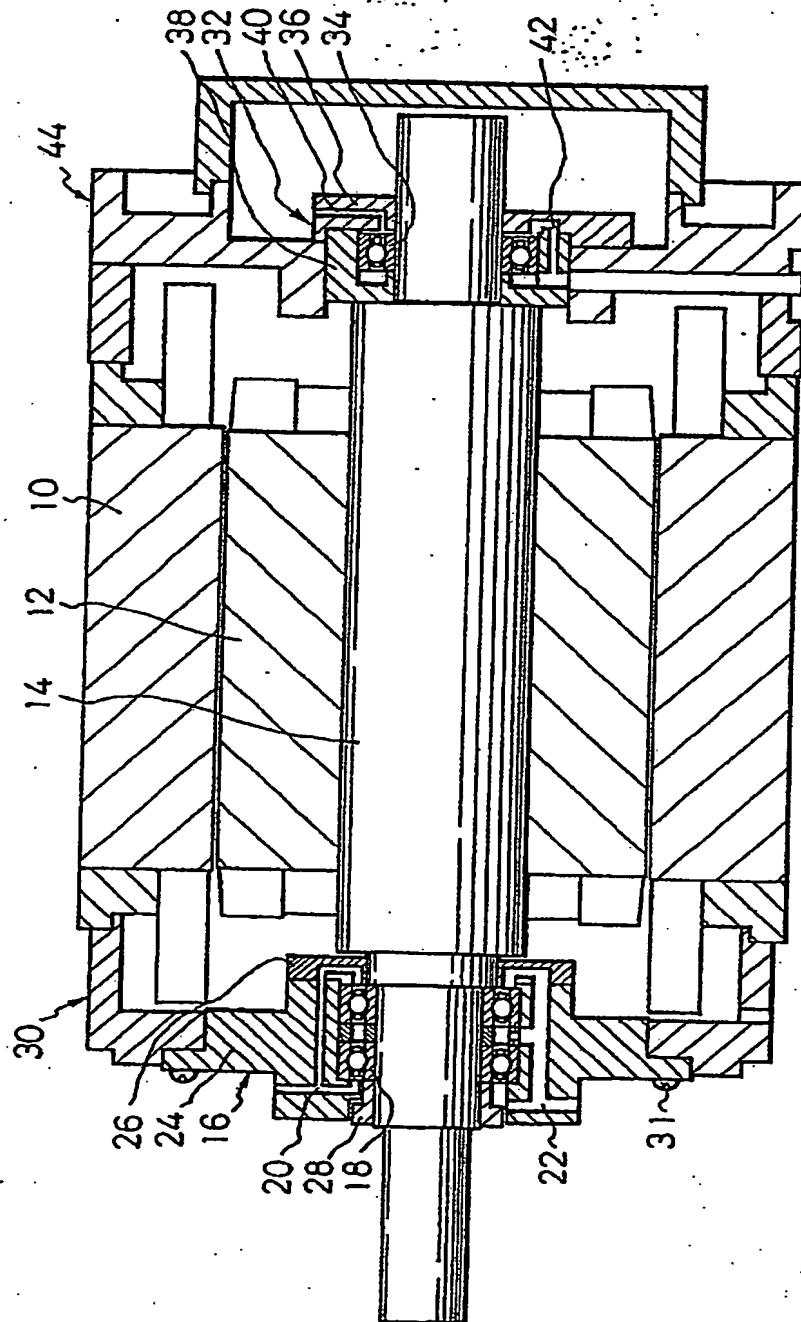
2. A structure of a journal bearing for a motor  
for operating at a high revolutionary speed according to  
claim 1, wherein said motor has a built-in spindle  
25 serving as a spindle of a machine tool, and said output  
shaft is integral with said spindle.



00289610

1/1

Fig. 1



# INTERNATIONAL SEARCH REPORT

International Application No.

00289610  
PCT/JP87/00772

## I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) \*

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl<sup>4</sup> H02K5/173

## II. FIELDS SEARCHED

Minimum Documentation Searched \*

Classification System \*

Classification Symbols

IPC H02K5/16-5/173, F16C33/30-35/078

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in the Fields Searched \*

Jitsuyo Shinan Koho	1926 - 1987
Kokai Jitsuyo Shinan Koho	1971 - 1987

## III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>14</sup>

Category *	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>
------------	--	-------------------------------------

A	JP, B2, 34-4703 (Itaya Matsuki) 6 June 1959 (06. 06. 59) Drawing (Family: none)	1-2
---	---	-----

### \* Special categories of cited documents: <sup>19</sup>

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step
- "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

## IV. CERTIFICATION

Date of the Actual Completion of the International Search \*

January 5, 1988 (05. 01. 88)

Date of Mailing of this International Search Report \*

January 18, 1988 (18. 01. 88)

International Searching Authority \*

Japanese Patent Office

Signature of Authorized Officer <sup>20</sup>

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☒ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**